1983

ANNUAL REPORT

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SASKATCHEWAN RESEARCH COUNCIL

THE RESEARCH COUNCIL ACT, 1965.
Clause 21, in part, directs that:

1. The Council shall on or before the last day of February in each year submit to the Lieutenant Governor in Council a report of its proceedings and transactions during the next preceding calendar year, which report shall contain such particulars as the Lieutenant Governor in Council may prescribe.

2. Every report shall forthwith be laid before the Legislative Assembly if then in session or, if it is not in session, within fifteen days after the opening of the next session.

Regina, February 22, 1984

TO THE HONOURABLE F.W. JOHNSON

Lieutenant Governor of the
Province of Saskatchewan

MAY IT PLEASE YOUR HONOUR:

The undersigned presents herewith, for your consideration, the report of the Saskatchewan Research Council for the year ended December 31, 1983.

Respectfully submitted,

Gordon Currie,
Minister responsible for
Saskatchewan Research Council

PLEASE ADDRESS CORRESPONDENCE TO:

Saskatchewan Research Council
30 Campus Drive
Saskatoon, Saskatchewan
S7N 0X1
Telex: 074-2484

MEMBERS OF THE SASKATCHEWAN RESEARCH COUNCIL

The Honourable Gordon Currie, Chairman
** The Honourable Jack Sandberg, Chairman
J. Hutch, Vice Chairman
** D. Murray, Secretary
* G.C. Birney
* C.W. Blachford
** E.B. Campbell
** B.M. Craig
M. de la Gorgendiere
A.J.Y. Guy
L. Katz
H.S. Maliepaard
K.J. McCallum
J.P. Melin
B.M. Michel
P.N. Nikiforuk
** J. Perkins
J.W.T. Spinks
B. Thompson

* Reappointed, 1983.
** Appointment lapsed, 1983.

EXECUTIVE OFFICERS OF THE COUNCIL'S STAFF

President	J. Hutch
Director of Special Projects	J.L. Bergsteinsson

Sector Directors

Environment	J. Maybank
Industrial Technology Transfer	A. Scharf
Resources	W.H.W. Husband
Services	W. Spyker

Manager, Corporate Services	R.E. Melvin
Treasurer	R. McGrath

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PROCEEDINGS OF THE COUNCIL

There were eighteen members on Council at the beginning of the year. The term of office of nine members expired during the year and the vacancies are being filled by re-appointments and new appointments. Council expresses its thanks to those members retiring.

The Honourable Gordon Currie replaced the Honourable Jack Sandberg on Council.

Dr. Tom Pepper retired as President and was replaced by the appointment of Mr. Jim Hutch.

Council met to receive reports of the Executive Committee and the President, and to formulate policy and priorities for the Council Program. Implementation of a Long Range Plan started April 1, 1983.

The Executive Committee consisting of the Council Chairman, Vice Chairman, Secretary, and Dr. L. Katz and Dr. B. Craig with the President as Secretary, met twice during the year. The main activities of the Committee were to review Council operations and to recommend to Council on policy and major program issues.

PRESIDENT'S REPORT

The Saskatchewan Research Council reflects the uniqueness of Saskatchewan as it adapts its activities to meet the needs of the province. SRC's role is to generate, locate and disseminate technology and technological innovations which contribute towards economic activity and job creation.

The year 1983 was a year of transition at SRC. A Long Range Plan was implemented which orients SRC's services to the market place. To the people of Saskatchewan this means that the SRC is active in areas relevant to their concerns such as research and development in the resource area. Work is carried out relating to the solution of problems with respect to our towns, villages and farm residents' water supplies, and matters relating to energy conservation.

Saskatchewan has 49 per cent of the world's potash reserves, 20 per cent of western world uranium reserves, and on average 12 per cent of the world wheat export. Seventy per cent of our towns, villages and farm residents depend on groundwater. The province has the highest space heat requirements per household in Canada, as well as the largest per capita transportation energy requirements.

To our manufacturing industries the SRC is an extension of their research and development expertise and departments or in the case where the industry has no R&D capabilities, SRC can provide their total requirements. To resource development industries the SRC is available for use as an extension to their R&D expertise and facilities.

Each sector has its special technology needs and SRC adapts to accommodate these needs.

For example, the manufacturing sector requires specialized assistance to assure it continues to operate and grow. SRC provides expertise in industrial engineering, product development and diversification. As well it can assist with productivity and cost reduction through the utilization of the latest technologies.

SRC recognizes that small and medium-sized enterprises have a greater need than ever before for information and technical services to assist them in improving productivity and competitiveness. The SRC also recognizes its role as a partner with industry, federal and provincial governments and agencies, and post-secondary institutions in creating economic activities as recently outlined in the Science Council of Canada paper "Partners in Industrial Strategy." SRC serves the needs of resource based industries, energy conservationists, agricultural researchers and is a "veritable research arm for hundreds of small and medium-sized enterprises, and an important segment of industry for employment and creation of wealth of the country."

In 1983, the Canadian Centre for Advanced Instrumentation completed its first full year of operation and is making important contributions toward the advancement of instrumentation techniques and design.

New technologies and the application of high technologies point the way to a resurgence in the province. To meet the needs of today and the future, SRC is actively engaged in the implementation of computer-assisted design and computer-assisted manufacturing (CAD/CAM). As the science scene changes, so does SRC - adjusting to make science serve Saskatchewan.

The Saskatchewan Research Council's 1983 revenue was approximately $10.1 million dollars. $3.5 million was in the form of a grant from the Province of Saskatchewan. This funded core research and development is dedicated to working on problems of relevance to Saskatchewan and its economic development. The remaining $6.6 million dollars was generated in revenue through contract work for provincial government departments, the federal government, and various companies in Saskatchewan and Canada. A number of contracts were in collaboration with Saskatchewan consulting firms.

Implemented science and technology is a job creator, emphasizing SRC's important role in the provincial economy. SRC is staffed with scientists, engineers, technologists and support staff, dedicated to excellence in their task. As the new President of SRC, I am pleased to be part of a team working towards the development of Saskatchewan's full potential.

PROGRAM OF THE COUNCIL'S STAFF
ENVIRONMENT SECTOR

INDUSTRIAL HYGIENE E 781-1

OBJECTIVES

The project investigates the quality of work environments to recognize, and evaluate potential health hazards in Saskatchewan industries.

MILESTONES

Project staff conducted: field evaluations of commercial dust monitors in potash production environments; case studies on formaldehyde and asbestos particles within institutional buildings and homes; and in a new area of activity this year (with a grant from the Saskatchewan Health Research Board), performed laboratory evaluations of a personal alpha dosimeter intended for use in the mining industry. In addition, the group provided general consultation in Industrial Hygiene to the University of Saskatchewan Department of Social and Preventive Medicine.

WATER RESOURCES MANAGEMENT AND POLLUTION ABATEMENT E 904

OBJECTIVES

The program objectives are to develop solutions to problems which occur during and after the development and utilization of agricultural and industrial resources in Saskatchewan; and to identify the environmental problems which would restrict the utilization of the province's land and water resources for economic and recreation development, and to find long-term solutions through target-oriented research.

MILESTONES

In 1983, field data from the Humboldt demonstration project have been used to develop design criteria for designing sewage treatment systems using artificial wetlands. Through the final report, and numerous seminars, and public lectures, communities and academic bodies throughout North America have been exposed to this treatment technology. Work done at Humboldt has demonstrated that the potential benefits of the improved sewage and water treatment technology can be applied to other Saskatchewan towns and villages, feedlots, and recreational areas.

The Freshwater Biological Research Foundation of Minnesota has shown active interest in carrying out joint research projects with SRC for utilizing the aquatic plant concept in Minnesota.

Preliminary work on the loss of fertilizer value from hog manure during storage has shown that up to 80% of nitrogen can be lost during the first 10 days of storage. The carbon-to-nitrogen ratio largely determines the loss rates. The data obtained are quite valuable in conserving nitrogen in animal manure and in improving the economics of farm operations.

Water and sediment data from Humboldt Lake were collected in an effort to understand lake pollution and develop practical guidelines for restoring polluted lakes in Saskatchewan.

Various communities in Saskatchewan were visited to understand and solve their sewage and water problems.

A project proposal is being developed for the Meadow Lake area to develop a viable industry based on the utilization of wetland vegetation. Preliminary consultations with the Northwest Economic Development Council and the Councillors from the Meadow Lake district have been encouraging.

Efforts are underway to generate research studies to improve the potential of Saskatchewan lakes for tourism and recreation. The data from SRC studies will be applied to solving aquatic weed and water quality problems in Pike Lake and develop management guidelines.

A preliminary paper showing the potential application of biotechnological concepts for ore leaching and metal recovery was presented at the BIOMINET, CANMET, EM&R, Ottawa inaugural meeting.

SURFACE HYDROLOGY E 905

OBJECTIVES

This project involves research to identify present and potential problems related to the quality and quantity of surface water resources in Saskatchewan; to develop process knowledge and management alternatives; and to develop environmental quality monitoring equipment specific to the needs of the province, as well as national and international clients.

The project provides essential hydrological and remote sensing input to environmental impact studies in Saskatchewan, for developments such as uranium mines, potash plant expansions, and hydroelectric and thermal power plants.

The project is partially core-funded as well as contract-funded.

MILESTONES

This year work included provision of hydrological and remote sensing input to environmental impact and uranium tailings studies in Saskatchewan; development of water quality monitoring equipment; and repair and servicing of satellite retransmission recorders.

Ten years of urban runoff data for Saskatoon have been analysed to provide design criteria for highway underpasses and municipal sub-divisions.

ATMOSPHERIC PROCESSES E 906

OBJECTIVES

This project is a study and classification of the behavior of atmospheres. It involves establishing a long-term reference guide of weather parameters; monitoring air pollution in the form of acid rain or ambient herbicides in the atmosphere; modelling the short-and long-term dispersion of pollution within the atmosphere; and, on a contract basis, sampling stack gas emissions for provincial industries.

MILESTONES

The project staff continue to monitor air pollution emissions for major industrial sectors. This year, 12 clients contracted for stack emissions sampling, and about 50 separate tests were performed.

Testing techniques used are adaptable to data generation particular to the user's site and applicate needs.

The standard techniques of meteorological determination and air quality measurement conform to all applicable federal and provincial regulations.

Benefits of the project include establishing a common base for studies in the atmospheric sciences. Data generated in each sector of the provincial economy are useful to all on a comparative basis, because common techniques are applied throughout.

In the future, project research will form an important component in establishing a data base of all environmental and air quality data collected within the province.

ENVIRONMENTAL RESEARCH AND INDUSTRIAL DEVELOPMENT IN SASKATCHEWAN

Industrial development in Saskatchewan must meet specified requirements with respect to predevelopment environmental impact assessment and post development monitoring, decommissioning and reclamation. The Saskatchewan Research Council maintains a multidisciplinary team of experts to assist industry in areas of environmental protection. SRC is ideally suited to develop and maintain a regional environmental data base, and to undertake research and development technologies which will assist industry and participating environmental consulting companies in fulfilling their commitment to environmental protection.

MILESTONES

The Environmental Sector of the Saskatchewan Research Council has been involved in environmental impact assessments and environmental research for more than 10 years. In recent years we have

directed our attention to research which would facilitate the impact assessment process. Extensive studies have been undertaken in areas such as water quality, radionuclides in the environment and mine site reclamation. A critical evaluation of several impact assessments has been completed for a region of northern Saskatchewan to provide a basis for further regional studies. The evaluation identifies a potential area for improving the environmental impact assessment process with considerable savings to industry in costs and time.

The following brief summary outlines the progress this year in a number of environmental research projects associated with industrial development in Saskatchewan.

REGINA — MOOSE JAW WATER QUALITY STUDY

OBJECTIVES

The objective of the study is to provide additional water quality data from Lake Diefenbaker, the Qu'Appelle River and Buffalo Pound Lake to aid in assessment of alternative solutions to the water supply and water quality problems of Moose Jaw and Regina.

MILESTONES

This project provides detailed water quality and phytoplankton data for use by the cities of Regina and Moose Jaw, Saskatchewan Environment, Saskatchewan Urban Affairs and PFRA in their decision-making regarding future plans for dealing with the water supply problem.

Data are on computer files and will be made compatible with Saskatchewan Environment's water quality data base.

SASKATCHEWAN RIVER WATER QUALITY MONITORING E 901-10
(FUNDED BY SASKATCHEWAN POWER CORPORATION)

OBJECTIVES

The objective of this study is to provide post impact-assessment monitoring to identify changes to the Saskatchewan River during the construction phase of the Nipawin Hydroelectric Project.

MILESTONES

Water samples were collected from six locations on the Saskatchewan River approximately monthly during 1982 and quarterly in 1983. Samples were analyzed for a wide range of parameters (including major ions, nutrients, heavy metals, and physical properties). Quarterly monitoring of deep-well discharges was initiated in 1983.

SASKATCHEWAN REPRESENTATIVE (ON BEHALF OF SASKATCHEWAN ENVIRONMENT) ON THE PRAIRIE PROVINCES WATER BOARD'S COMMITTEE ON WATER QUALITY.

OBJECTIVES

The Committee on Water Quality is a federal-provincial technical committee which meets regularly to assess the water quality of inter-provincial rivers, to exchange information and to develop water quality requirements at provincial boundaries.

MILESTONES

SRC's representation on this committee provided important technical expertise, and kept council environmentalists apprised of new directions in the work of the Prairie Provinces Water Board.

RADIONUCLIDES PATHWAYS: HEAVY METALS IN WATER E 901-7

OBJECTIVES

Research has indicated that uranium mining activities in northern Saskatchewan deposit radionuclides in lake and stream sediments, beginning a chain of contamination that may affect man through the consumption of contaminated fish.

This project will describe uranium-series radionuclide transport through the foodchain in the Beaverlodge area of northern Saskatchewan associated with Eldorado Nuclear's uranium mine and mill. The study will determine the transfer coefficients and potential dosage to man.

The data will have broad application to transfer pathway studies at other uranium mining and high background level locations. Research results will be entered into the National Uranium Tailing Program database.

MILESTONES

Data were collected this year from the Beaverlodge, Milliken and Fredette Lakes in the Uranium City area.

The information will be used specifically in the decommissioning process of the Eldorado Nuclear uranium mine and mill.

FOODCHAIN TRANSFER OF RADIONUCLIDES E-901-17
(FUNDED BY SASKATCHEWAN HEALTH RESEARCH BOARD)

OBJECTIVES

Objectives of the study are to sample all the components of the primary foodchain in the enclosed Gunnar pit, to enable calculation of transfer coefficients; to further clarify uptake rates, interspecific variation and the relative importance of uptake via food; and to help predict possible consequences of flooding of other open pits in northern Saskatchewan.

MILESTONES

Field data were collected this year, and analysis is in progress.

When complete, the project will contribute valuable data on radionuclide transfer in a confined, unambiguous foodchain leading to northern pike. This will aid in the prediction of impacts of other uranium mines and will also contribute to the understanding of the movement of contaminants in foodchains in general.

FISH PARASITOLOGY: BEAVERLODGE AREA E-901-20
(FUNDED BY SASKATCHEWAN HEALTH RESEARCH BOARD)

OBJECTIVES

This project will compare levels of parasitism in fish from Beaverlodge Lake (with elevated radionuclide levels), and two control lakes.

The study provides further data on possible effects of low-level radiation on fish populations.

MILESTONES

Data were collected and analyzed from fish populations of Beaverlodge, Milliken and Fredette Lakes in the Uranium City area.

Research will contribute to a general understanding of the scope and nature of problems related to the release of uranium mill tailings effluent.

EFFECTS OF CHRONIC LOW-LEVEL RADIATION ON FISH E-901-20
(FUNDED BY SASKATCHEWAN HEALTH RESEARCH BOARD)

OBJECTIVES

This study will examine fish blood parameters from Beaverlodge Lake and two control lakes, examine fish blood-forming tissues for abnormalities and note lesions and parasites through routine postmortems.

MILESTONES

All fish blood parameters were examined and analyzed this year, with the exception of immunoglobulins. Tissue samples are presently being examined.

Compilation of back-up radiological data is complete; a database literature search, statistical analysis and report writing are in progress.

The work involves new techniques for immediate fish blood sampling and centrifuging to ensure maximum reliability of data. The project will provide valuable data upon which new water quality criteria for radionuclides can be based. These criteria are, at present, being revised according to guidelines in the Fisheries Act regarding discharges affecting fish and fish habitat.

COMPILATION AND ANALYSIS OF A DATA BASE ON URANIUM RADIONUCLIDES IN AQUATIC BIOTA IN NORTHERN SASKATCHEWAN E-901-17
(FUNDED BY SASKATCHEWAN HEALTH RESEARCH BOARD)

OBJECTIVES

Objectives of the study are to collect, organize, enter into computer files, and statistically analyse all available data on radionuclides in aquatic plants, invertebrates and fish in northern Saskatchewan.

MILESTONES

Data have been identified and obtained from many different sources, including unpublished material. Entry and analysis is in progress.

This work complements the work of the National Uranium Tailings Program and its database which includes geological, hydrological, geochemical, physical and biological data pertaining to uranium mines.

REVEGETATION OF SODIC COAL SPOILS — FIELD TRIALS E 901-14 (FUNDED BY SPC)

OBJECTIVES

Sodic coal spoils are common in southern Saskatchewan, particularly in the Estevan area. Strip mining for coal has resulted in nearly 7000 ha. (17,200 acres) of disturbed land since its initiation in the early 1930's. At present, at least 250 ha. (600 acres) of land are overturned each year.

The following four projects investigate problems associated with reclaiming the land for productive agriculture use (in the Estevan area) and rangeland (in the Coronach area). Determining proper soil treatment and selection of appropriate plant species will allow successful large-scale revegetation projects.

Information acquired in this work will be useful in future reclamation/revegetation studies in other areas of the province, particularly around northern uranium mines.

This project's objective is to select suitable plant species for direct seeding on coal spoils, and to determine suitable soil amendments to improve seedling emergence, establishment and productivity.

MILESTONES

Three experiments were conducted in the spring and fall of 1983. Thirteen plant species, including a number of native grasses, were used. Soil amendments used included leonardite, bottom ash, gypsum, calcium chloride, hay and straw.

REVEGETATION OF NON-SODIC COAL SPOILS - EVALUATION OF THE 1979 EXPERIMENTS AT ESTEVAN AND CORONACH E 901-14 (FUNDED BY SPC)

OBJECTIVES

The project objective is to conduct an ecological field evaluation of the 1979 revegetation experiments in the Estevan and Coronach areas. The experimental variables being tested included species, fertility level, row spacing and time of seeding.

MILESTONES

Fieldwork was completed in the fall of 1983. Chemical analysis and data analysis are underway.

It is expected that specific recommendations regarding large-scale revegetation operations of non-sodic spoils in two regions will be formulated on the basis of the findings of this study. Application of such recommendations will result in more cost-effective revegetation operations.

LEVEL OF COPPER AND MOLYBDENUM IN REVEGETATED COAL SPOILS E 901-4

OBJECTIVES

The project objective is to determine the copper and molybdenum levels in the main forage plants growing on coal spoils in the Estevan area to determine the potential for molybdenosis, an animal nutritional imbalance (copper deficiency resulting from the depressing effect of molybdenum on the physiological availability of copper in ruminants).

MILESTONES

Preliminary analysis of the data indicates the Cu:Mo ratios are below the 5:1 ratio at or below which molybdenosis has been reported to occur. These variations should be taken into consideration when selecting plant species for revegetation projects. The practical significance of these low ratios requires investigation by animal nutritionists.

REVEGETATION OF SODIC SPOILS - LABORATORY EXPERIMENTS, E 901

OBJECTIVES

Project objectives are to conduct a laboratory screening of potential revegetation species for possible use on sodic spoils in southern Saskatchewan, and to conduct laboratory investigation on methods for improving the chemical and physical characteristics of the sodic spoils to facilitate plant establishment and increase productivity.

MILESTONES

Preliminary experiments have been completed. These involved testing 20 species of grasses and legumes, including a number of native species. Spoil amendments included gypsum, calcium chloride, leonardite and bottom ash.

Controlled revegetation experiments under laboratory conditions represent an important step in that they reduce the number of variables to be tested in the field and enable clearer interpretation of the results.

ENVIRONMENTAL IMPACT ASSESSMENT - PHASE II, CLUFF LAKE E 901 (FUNDED BY CLUFF MINING)

Environmental impact assessments are an important part of major industrial projects, particularly mining activities in ecologically sensitive areas for northern Saskatchewan.

The following three projects detail work in this area.

OBJECTIVES

The project objective is to conduct environmental baseline studies for the second phase of the Cluff Lake Uranium Development in northwestern Saskatchewan and to prepare an environmental impact statement for the project.

MILESTONES

The study is now complete. The SRC environmental studies team worked closely and effectively with Cluff Mining and other uranium companies in the environmental assessment and planning of the project in order to ensure minimal potential environmental impacts from the project through: (1) planning of proper mitigation measures, (2) selecting site and development alternatives that are more environmentally acceptable and (3) developing effective environmental monitoring programs.

ENVIRONMENTAL BASELINE DATA CRITIQUE - WOLLASTON LAKE REGION E 901-15 (FUNDED BY SASKATCHEWAN MINING DEVELOPMENT CORPORATION)

OBJECTIVES

The project objective is to examine and assess the available environmental baseline data for the Wollaston Lake uranium region in order to determine their completeness and usefulness to serve as baseline for future developments (e.g. uranium mining and milling, roads) in the region.

MILESTONES

The study is now completed.

An inventory of the available baseline data was conducted. The inventory will facilitate locating the types and sources of data presently available, thus, providing a basis for more effective environmental planning and reducing the cost of future environmental studies.

The study identified the need for standardizing environmental sampling and analysis methodologies and for considering the impact of present and potential developments in a regional context.

The study provided specific recommendations for improving future environmental baseline and monitoring studies pertaining to the aquatic, terrestrial, atmospheric and socio-economic components of the environment.

NATURAL REVEGETATION ALONG A POWER LINE AFTER TORDON SPRAYING, URANIUM CITY AREA E 901-1 (FUNDED BY ELDORADO RESOURCES LIMITED)

OBJECTIVES

The project objective is to examine the natural vegetation pattern following spraying of the power line right-of-way with the herbicide Tordon and to determine whether areas beyond the sprayed zone are affected. Herbicide application is an effective method of land clearing for industrial right-of-way development, but improved methods are needed to avoid unnecessary damage to adjacent areas.

MILESTONES

Preliminary fieldwork has been completed. Analysis of the results is underway.

ARCHAEOLOGY PROGRAM

SRC's archaeologists maintain an active program of field site excavations and laboratory analysis to record evidence of human habitation in Saskatchewan in historic and prehistoric periods. Two projects dominated the program work this year: one core-funded project on Laurel Culture material; and a second contract project from the Saskatchewan Power Corporation in areas adjacent to the Nipawin Reservoir hydro-electric construction site.

A STUDY OF LAUREL CULTURE MATERIAL IN NORTHERN SASKATCHEWAN

OBJECTIVES

Laurel Culture sites have been recognized in the eastern forests of Saskatchewan for over 20 years; however, very little has been written about the presence of this culture in the province. The Saskatchewan Laurel occupation is important since it represents the most northwesterly extremity of a hugh area of the forests of Manitoba, Ontario and northern Minnesota in which the Laurel peoples lived ca. A.D. 100-900. The object of the present study has been to draw together the Saskatchewan information and to present a summary of the characteristics of the Laurel occupation.

MILESTONES

The distinctive Laurel pottery was noted in collections from 31 sites in northern Saskatchewan.

In Saskatchewan, Laurel is present in the region encompassing the Sturgeon Weir, eastern Churchill and Reindeer Rivers. Rare occurences outside of this area are present on the Saskatchewan River, Lac La Ronge and in Prince Albert National Park.

Radiocarbon dates have not yet been run on Saskatchewan Laurel, but the decorative features of the pottery are those characteristic of late Laurel in the provinces to the east. Therefore, it is believed that the Laurel occupation of Saskatchewan also was late.

It is evident that the Laurel occupation of northern Saskatchewan was substantial. Better data are required on the geographical extent and the age of this occupation, as well as detailed information on the stylistic characteristics of the artifact assemblages.

NIPAWIN RESERVOIR HERITAGE STUDY E 903-10

OBJECTIVES

The objective of this program is to mitigate the impact on archaeological resources resulting from the construction and operation of the Nipawin hydro-electric station, and to obtain information on the culture, history and lifestyle of the river valley occupants in the past 6000 years or more.

MILESTONES

In the third year of this program:

- probabilistic sampling survey was completed and all sections of the reservoir cleared of forest were examined, locating 23 new sites and 11 find spots.
- test excavation/detailed assessment was completed at 10 sites.
- site relocation and limited assessment program continued, 43 sites and nine find spots were examined.
- remains of two buildings and numerous artifacts of the period (1793-95) were found at Grant-McLeod fur trade post. One building was excavated.
- excavations at a Pehonan period site were completed, probably the most extensive excavation in the province to date: 548 m^2 of site exposed.
  Provided extensive evidence of repeated overlapping occupations (A.D. 1500-1700).
- Avonlea period occupations, ca. A.D. 40-900, were found at two sites.
- excavation of the Eastcott Flat site was completed, a Pelican Lake period occupation dating to 2,490 years ago.
- further evidence found of Mckean period (ca. 3,400 years ago) and Mummy Cave period occupation (ca. 5,500 years ago).

INDUSTRIAL TECHNOLOGY TRANSFER SECTOR

PRODUCT AND PROCESS DEVELOPMENT T 4300

OBJECTIVES

This program expedites the effective transfer of CAD/CAM and associated technologies to Saskatchewan industry.

MILESTONES

A consultant's report outlining a CAD/CAM Robotics Centre for Saskatchewan was completed this year. The study was funded in part by a Department of Regional Industrial Expansion Federal/Provincial Planning Agreement. The report is being used to guide the implementation of such a centre at SRC.

This year marked the formation of a CAD/CAM Training Consortium, including SRC, the Department of Advanced Education, and the two provincial universities. The consortium will aid in organization and rationalization of the CAD/CAM training effort in Saskatchewan.

The work of the Product and Process Development Group this year resulted in significant estimated development cost savings for Saskatchewan manufacturers.

Fourteen Product Analysis projects were completed, involving computer simulations of the performance of new or existing products, resulting in a total estimated development cost saving of $310,000.

Two Product Engineering projects redesigned existing products or processes to meet technical requirements, resulting in estimated savings of $70,000.

Two Systems Engineering projects assisted companies to computerize their operations. Estimated cost savings: $50,000.

Five New Technology Development projects were initiated to develop group skills, and expand services into new areas. Estimated savings totalled $170,000.

IRAP SASKATCHEWAN T 4200

The Industrial Research Assistance Program (IRAP) is a co-operative program of the Saskatchewan Research Council in Saskatoon, and the National Research Council of Canada.

SERVICES

The purpose of the program is to provide technological information, advice and guidance on industrial engineering methods and techniques, and limited assistance to the province's small and medium-sized manufacturing firms in respect to company functions and production operations.

The services that IRAP provides are free and confidential.

IRAP/Saskatchewan has direct access to a national network of resource centres, which enables IRAP engineers to obtain information on most technical subjects promptly. In confidence, IRAP engineers will search out the answers or solutions to technical problems or inquiries that are related to manufacturing and production. This service is particularly useful to small and medium-sized companies that do not have engineering and research personnel or library facilities. The technical information service is also valuable to those manufacturers who need, or wish to be informed of, the latest developments of innovations in their fields.

Under the student projects program, small manufacturing firms employing scientific or technical students in a technical capacity, for a designated period of time, are eligible for financial contributions from the National Research Council, to be used towards the students' salaries. The objective of the program, which is administered by IRAP/Saskatchewan personnel, is to assist in the transfer of technology. The students gain valuable experience and the firms receive student assistance with their technical or engineering problems. IRAP provides direct student supervision and guidance and assists the firms in the selection of the appropriate student. Approved projects, such as plant layouts, production engineering, product development, or computer application, receive financial support based on the student's educational level.

NRC's financial support is made available to small manufacturing firms (firms employing less than 200 people) that require technical or scientific laboratory work. Laboratories, institutions, and consultants can be contracted by the manufacturer to undertake such work as product testing, metallurgical investigations, chemical analysis or computer modelling. The research activities are expected to lead to benefits such as cost savings, increased production, or processes and quality improvements.

IRAP Saskatchewan assists manufacturers in determining the research to be undertaken and in locating the appropriate institution.

The purpose of IRAP-M is to encourage small manufacturing companies (up to 200 employees), with little or no technical staff, to solve specific technical problems. This can be achieved either by utilizing their own technical personnel or with the aid of a selected research organization. IRAP-M provides NRC's financial assistance to cover the salaries of those professionals and technicians working on the approved project.

IRAP-P provides assistance to Canadian incorporated industries for long term applied research projects. Projects that are eligible for financial contributions must be scientifically feasible, commercially realistic, and have a marketable end-product or process for which a demonstrable need or opportunity is forseen.

The purpose of the IRAP-P program is to promote and increase scientific research with technical merit as it applies to industry, with the end result being economic or social benefit to Canada. This objective is pursued by extending financial support to approved research workers whether they are associated consultants or employees of the participating company.

MILESTONES

In 1982-83, IRAP personnel visited 756 plants, and handled 1311 inquiries. In 20 cases, immediate benefits were reported by the companies. Fifteen student projects and 12 laboratory investigations were initiated.

Some measurable benefits accruing to Saskatchewan manufacturers who used the services of IRAP were: 52 jobs were created or saved, and $21.5 million in additional sales were generated.

INDUSTRIAL ENGINEERING AND MANAGEMENT CONSULTING PROGRAM T 4500

OBJECTIVES

This project promotes the productivity and effectiveness of industry, business, government, and other organizations by providing industrial engineering consulting services and guidance in the application of appropriate physical, and management technologies.

MILESTONES

With the financial assistance of the Saskatchewan Department of Tourism and Small Business, SRC manages the Federal DRIE Product Development Management Program in Saskatchewan (PDMP). Under this program, approximately 15 Saskatchewan manufacturers were assisted in product development feasibility studies and business plans. Productivity consulting assistance was provided to the City of Calgary, and a major Saskatchewan firm.

The two publications, Technology Transfer (quarterly) and Management Insights (6/year), continued to be published and directed at Saskatchewan's business and manufacturing community. Technology Transfer has a circulation of over 4000; Management Insights, 900.

Industrial Technology Transfer sponsors and presents public and in-house seminars on such topics as Materials Management, Industrial Marketing, Cost Leadership, Systems Design, Industrial Supervision, Time Management, CAD/CAM, and Welding Supervision. Through these seminars, SRC has developed and communicated new concepts in Productivity, Incentives, Product Development, and Quality Circle advancements.

During the year seven public seminars were held, with 150 participants. Six in-house seminars were provided to corporations and associations, with several hundred attendees.

RESOURCES SECTOR

GEOCHEMISTRY AND DATA ANALYSIS R 740

OBJECTIVES

This project develops and refines methods of geochemical exploration for uranium, base metals, and gold, which will be applicable to a variety of geological settings in Saskatchewan. The new exploration techniques are significant for the increased effectiveness they provide for mineral exploration.

The project, which is 95 percent core-funded, also conducts professional development seminars for exploration geologists, to communicate the technology and facilitate its application.

In detail, the project studies the behaviour of major and trace elements during geological processes, in particular during hydrothermal alterations related to the formation of mineral deposits; investigates approaches to the effective statistical analysis of lithogeochemical data; and develops a methodology for the application of lithogeochemistry to mineral exploration in Saskatchewan.

MILESTONES

Work in 1983 resulted in the development of a general strategy for the study of lithogeochemical data using correspondence analysis; development and application to Athabasca Basin drill sites of procedures for the assessment of down-hole alteration profiles; ongoing software development for the graphical analysis of data in a distributed processing environment; and development of Tails Analysis, a data analysis method for the study of element associations in anomalous concentration ranges.

From the response by geologists, it is evident there is a growing interest in using improved methods of geochemical data analysis to solve exploration problems in northern Saskatchewan.

GENESIS AND DEVELOPMENT OF METALLIC MINERAL DEPOSITS R 745-4

OBJECTIVES

The objective of the project is to investigate how mineral deposits have formed in Precambrian terrains of Saskatchewan and formulate criteria to develop improved exploration strategies, and assist in the discovery of new deposits.

MILESTONES

Several sub-projects occupied the research group in 1983.

An investigation of the lithogeochemistry of the Athabasca Group sandstones, from background to mineral deposit, required analyses of 540 background sandstone samples. The analyses consisted of Inductively - Coupled Plasma and Atomic Absorption procedures, with data output using interactive graphical univariate and bivariate analysis, followed by various multivariate methods. Clay mineral analysis by means of quantitative X-ray diffraction techniques has developed into a recognized tool in uranium exploration. The method has given exploration teams improved information in their diamond drilling, thus speeding the exploration process, and reducing costs.

Characterization of the lithogeochemistry of the Athabasca Sandstone will benefit mineral exploration in that region, as well as the ongoing studies on the metallogenesis of ore deposits associated with the sandstone.

Another sub-project, the Athabasca Diabase Investigation studied the setting of diabase dikes that cut the Athabasca sandstone. The study includes geochemistry, petrology, age determinations, and paleomagnetism. This in-progress work will add to the general understanding of the Athabasca Basin.

A third sub-project is Diagenesis and Mineralization in the Athabasca Basin. This project has been initiated to study the relationship between the development of unconformity-type uranium deposits and diagenetic processes in the Athabasca Basin. A suite of samples of Athabasca rocks has been collected and they are being prepared for isotopic and other types of analyses.

A paper was accepted for publication by the Canadian Institute of Mining and Metallurgy entitled "Host Rock Alteration and its Application as an ore guide at the Midwest Lake Deposit".

Sampling and mapping of the Rabbit Lake open pit is continuing.

MINERAL RESOURCES
X-RAY ANALYSIS LABORATORY R 745-5

OBJECTIVES

This project provides custom X-ray powder diffraction analyses for industry and for internal projects.

This facility is the only one of its kind in the province, providing an essential service to the province's mineral exploration industry.

MILESTONES

In 1983 routine data reduction procedures were transferred from Sask Comp to an in-house microcomputer, with savings resulting. With the system providing computerized data acquisitions, sample changing and data reduction/output, a maximum monthly capacity of 1400 samples is available.

Revenue to November 1983 totalled $60,000.

CERAMIC RESEARCH R 720-4

OBJECTIVES

The objective of the ceramic project is to research methods of upgrading the quality of Saskatchewan's large reserve of kaolin-base clays, and thereby improve the economic viability of the product. The clays, if improved, would command wider acceptance and higher prices in the paper, paint and art pottery markets.

MILESTONES

Work done this year was in two main areas: purifying stoneware clays, and kaolin bleaching.

Saskatchewan stoneware clays are lessened in value in the art pottery market because they often contain specking material, mainly iron oxides. Experimentation on removing the iron oxide by selective agglomeration was fruitless. Removal by Froth Floatation had some success, but only for certain clays.

Bleaching kaolin is of economic interest as there are large reserves of kaolin-containing material in southern Saskatchewan, which yield a material too dark for use in paper or paints. It has been determined that agitation of the kaolin in warm, weak alkali removes some organic contamination, and increases the whiteness of the product marginally.

TRANSPORTATION ENGINEERING R 725

OBJECTIVES

The objectives remain the advancement of slurry pipelining technology, and provision to industrial contract clients of specific pipelining expertise, test facilities and in-plant assistance.

MILESTONES

Work performed under contract this year included:

- pipeline testing of tar sand tailings for Syncrude Canada Limited.
- pipeline testing of gold mine tailings for Kiena Gold Mines Limited.
- pipelining of coarse coal in water slurries for Pembina Resources.
- pipeline testing of dense coal slurries for Techman Engineering.
- evaluation of transportation options for Saskatchewan heavy oils for Saskatchewan Department of Energy and Mines. This work will be significant for future developments in Saskatchewan's resources sector: heavy oil deposits are restricted to the west-central area of the province, while the first heavy oil upgrader facility will be in the south. Transportation options will be a central concern in linking the resource to refining capabilities.

LIQUEFACTION OF SASKATCHEWAN LIGNITE R 830-8

Saskatchewan has large reserves of lignite coal, being used primarily now for thermal electricity generation. Such coal can be used in the future to replace depleting conventional crude oil supplies as a feedstock for refineries, after the intermediate step of liquefaction.

OBJECTIVES

Work has been done to develop a process for liquefying Saskatchewan lignite, using a low reaction temperature and increased reaction time.

MILESTONES

Research has shown that Saskatchewan lignite is amenable to liquefaction using a process that incorporates heavy oil as a solvent. Saskatchewan's developing heavy oil reserves would complement the process, making it locally viable.

ROCK MECHANICS LABORATORY - TRIAXIAL TEST FACILITY R 830-10

OBJECTIVES

The ten triaxial test cells in this facility were constructed to study the rock mechanics of evaporites, primarily potash. It is necessary to determine the creep parameters of rock within mines to predict structural stability, and the extent of possible minerals extraction.

MILESTONES

Under contract from the Department of Energy, Mines and Resources, a joint project has been started with the University of Saskatchewan Department of Geological Sciences. This project will evaluate one of the triaxial test cells to determine performance expectations, auxiliary controls, and reproducibility of test data, preliminary to putting the whole facility in service for potash research.

INSTRUMENTATION FOR TOTAL EXTRACTION MINING OF POTASH R 830-18

OBJECTIVES

This project is developing instrumentation for the remote measurement of geomechanical properties of rock associated with the total extraction system of potash mining, and in conjunction with backfill of moist salt tailings. This new developing system of mining will increase the amount of potash available, in a given mine and alleviate surface tailings disposal problems, by using waste materials for structural support in mined-out sections of mines.

MILESTONES

A prototype remote rock deformation measurement system, utilizing a handheld computer as a data terminal, was developed for Potash Corporation of Saskatchewan Mining Limited this year, and installed in the Rocanville Division Mine. The long-term effects on this system of operation in the corrosive environment of a potash mine are being assessed, with a view to improving the design of the prototype system.

BIOFUELS RESEARCH R 711-8, -11, -16

OBJECTIVES

- to determine whether alcohol extraction of forages would yield whole plant oils which could be

modified to provide useful fuels or fuel additives (e.g. octane enhancers).
- to search for new whole plant oils or seed oils for fuel or industrial use with or without refining.

MILESTONES

In 1983 work on showy milkweed was discontinued when it proved difficult to remove toxic materials in the residue with alcohol extraction. This would prevent use of the residue as animal feed.

Alfalfa showed more promise as a source of whole plant oils. There was a small drop in feed value of the residue after alcohol extraction of whole plant oils. Work is progressing on determining the structure of the materials in the oils and in developing methods to modify the oils for various industrial and fuel uses.

While **Lunaria** gave high yields of an industrial type seed oil (high in erucic acid), the plant proved difficult to grow in Saskatchewan, and further work has been discontinued.

These projects were funded in large part by Agriculture Canada, and were done in collaboration with Enersearch, a private Saskatoon-based company.

With the drop in world crude oil prices, a change in emphasis is occuring in this type of biomass research. There is a move away from emphasizing liquid fuels as the main products towards finding high value products, such as fiber and industrial chemicals, as the main source of income from biomass refining. By-products would then be tested for conversion into liquid fuels.

BIOMASS PRODUCTION AND REFINING
(FUNDED JOINTLY WITH AGRICULTURE CANADA) R 711-10, -21

OBJECTIVES

- to test new or improved forage crops for growing on saline soils.
- to search for halophytic (salt accumulating) unconventional forages which might be used to reclaim saline areas.
- to develop methods to separate and process these forages to high protein feed, liquid fuel and other products.
- to develop new uses and new markets for forages to encourage inclusion of more forages in crop rotation.

MILESTONES

1983 research has demonstrated that kochia, a common wild plant, has considerable promise as a high yielding, salt accumulating, annual forage. On highly saline soils kochia yields up to nine tonnes of dry matter per hectare (four tons per acre). Plants accumulated 11 - 17% ash in dry matter. The highest yielding plants removed over a tonne of salt per hectare. During 1984 tests will be conducted to investigate whether this amount of salt removal would help in reclaiming saline areas for agricultural use.

Preliminary studies showed quite high feed value of kochia in the early to mid season stage of maturity. Feeding trials with sheep have been started in collaboration with Agriculture Canada Research Station at Swift Current.

Alfalfa, slender wheat grass and kochia have been investigated intensively during the biomass refining process. The cellulose and hemicellulose were enzymatically hydrolysed to simple sugars which could be fermented to yield fuel alcohols or industrial solvents. Methods were developed to recover forage proteins and to recycle the expensive cellulose enzymes. Our results to date suggest the need for drastic pretreatment to disrupt fibres physically to increase the yield of sugars in the enzyme hydrolysis step. Several commercial and experimental methods will be evaluated next year.

The agronomic sections of this project have been done in close collaboration with scientists from Agriculture Canada Stations in Saskatoon and Swift Current.

FARM ENERGY MANAGEMENT PROGRAM R 711-14

(A three-year study funded by the Provincial-Federal Joint Demonstration Agreement on Energy Conser-

vation). This is the third year of the program.

OBJECTIVES

- to help farmers test and implement specific methods, and implement integrated methods, to reduce the costs of farming associated with fuel, fertilizer and other energy intensive factors.
- to examine the energy saving implications of new cropping systems and measure the effects of energy cost saving methods.

MILESTONES

As a result of the Farm Energy Management Program, a variety of energy conservation actions have been taken by the 22 farmers associated with the study. These include retrofitting houses to reduce fuel use, buying more energy efficient farm machinery, reducing the number of field operations for a particular crop, testing methods of applying fertilizer at various rates to improve efficiency.

In collaboration with Brian Fowler, Crop Development Center, new production systems were analyzed for winter wheat which integrate snow management and zero tillage. Winter wheat exceeded spring wheat yields, and made more efficient use of fuel and fertilizer, often by a considerable margin. Use of certain expensive herbicides was markedly less with winter wheat compared to spring wheat, when zero tillage methods were tried for both.

The data on energy use for these strategies are being analyzed. Based on where energy is being used now, a plan is being developed with each farmer for methods to reduce costs associated with energy use (fuel, fertilizer, heating oil) while maintaining food production.

ENERGY SAVING CROPPING PRACTICES R 711-18

(A joint study with the University of Saskatchewan; funding provided by Agriculture Canada).

OBJECTIVES

This program will develop new energy efficient crop production systems, and integrate into farm practice combinations of: snow management; zero or minimum tillage; and legumes in crop rotations.

MILESTONES

The first year experimental results are now being collected. In earlier exploratory tests, a system combining spring wheat and sweet clover gave promising wheat yields and efficient use of energy (fuel and fertilizer). The sweet clover was chemically dessicated in early July and let stand as a mulch and snow trap over the next winter. Spring wheat was direct drilled into the standing clover stubble the next spring. This system of including sweet clover in a crop rotation of Saskatoon provided substantial biologically-fixed nitrogen and also retained sufficient soil moisture for a good wheat crop the following year. Liquid fuel use was 10 litres per tonne of wheat. This compared favourably to more conventional wheat production systems in the dark brown soil zone, where figures of 18-30 litres of fuel per tonne of wheat produced were required.

PRODUCTION OF EDIBLE MUSHROOM AND IMPROVED ANIMAL FEED BY WHITE ROT FUNGI R 814-15

Fermentation of Wheat Straw (funded by the National Research Council.)

OBJECTIVES

- to produce high value edible mushrooms (oyster mushrooms) by growing white rot fungi on straw and hay.
- to develop methods to simultaneously improve the feed value for cattle of the straw used to grow the mushrooms.

- to help develop a new Saskatchewan industry.

MILESTONES

Initial results have given good yields of oyster mushrooms (**Pleurotus** species) when grown on wheat straw. One species of oyster mushroom (**Pleurotus ostreatus**, the common oyster mushroom) significantly improved the feed value of straw. This result was obtained before the edible mushrooms were developed on the fermented straw. It remains to be determined whether simultaneous production of edible mushrooms, and improved feed straw (the spent straw left after harvest of the edible mushrooms) can be achieved.

Short-term consultations with a world expert in mushroom production helped in the developmental stages of the program. This program is planned to complement other current research in British Columbia and Ontario.

AQUACULTURE ENHANCEMENT E 901, E 905

Traditionally fish farming in Saskatchewan has consisted of small "put and take" operations whereby rainbow trout fingerlings are stocked in the spring in small bodies of water which are not capable of supporting a population on a year-round basis. The fish are harvested prior to freeze-up. A large proportion of such operations are hobby farms netting low returns, poor quality product and are generally unable to meet local market potential.

SRC's objective is to introduce cage culture techniques to maximize the use of available water resources for aquaculture to provide controlled growth and quality, and to achieve a 100 per cent harvest, thereby elevating fish farming from a hobby operation to a profitable adjunct to conventional farming.

Two years of field experiments have been completed. Through the use of cages and artificial feed SRC has demonstrated successful culture at stocking densities 15 times the rate of "put and take" operation with potential for densities of up to 30 times present rates. A 100 per cent harvest is guaranteed with considerable saving in time and discomfort since the fish are merely dipped from their cages rather than caught by gill net and seine in the traditional manner. Through controlled feeding the fish can achieve regulated growth to meet specified size, quality and market data.

Winter aeration experiments have shown that rainbow trout can be overwintered in cages in farm dugouts with minimum effort, to provide opportunities for a second season of growth when weight gains are up to four times that of the first year. Overwintering increases flexibility of harvest to provide fresh fish on a year-round basis, thereby capitalizing on higher prices in the off season.

Through intensive cage culturing techniques significant inroads can be made on available markets which are presently being satisfied through fish imports. Cage culturing provides opportunities for new forms of agriculture and profitable sidelines to existing agricultural practices.

Efforts have been directed to the following related projects.

CLOSED SYSTEM RECIRCULATING TROUT AND SALMON HATCHERIES

OBJECTIVES

Project objectives are production of fingerling supplies in Saskatchewan and Canada with high quality, disease-free fish for the current trout farming industry, as well as for the large race-way grow-out system. Additional enhancement of Saskatchewan's sports fishery is achievable with hatchery-produced fingerlings.

MILESTONES

One commercial 55,000-fingerling hatchery operated again in 1983; another will start construction in the spring of 1984 for start up in December 1984. A design and data retrieval contract for the latter unit is funded by the Department of Northern Saskatchewan. The first system is funded privately.

RACEWAY GROW-OUT SYSTEMS

OBJECTIVES

Project objectives are to enable table trout production of high tonnage to be achieved under some degree of controlled culture versus the capture fishery. Potential exists for Saskatchewan to raise 5400 tons of trout, char, and salmon per year.

MILESTONES

A 50,000 lb raceway system using a lake for water is in the design and costing stage, and construction will start in the spring of 1985.

FISH FARMING WORKSHOP (TWO DAYS)

COLD-WATER FISH CULTURAL SHORT COURSE (10 DAYS)

OBJECTIVES

The Fish Farming workshop course is designed to help present trout farmers enhance their recovery rate and to develop methods for product quality and marketing.

The cold-water fish cultural short course is designed to train new fish culturists for the hatchery and grow-out systems that will develop. It will ensure a positive growth of the industry, thus enabling world markets to be entered with quality products.

The Department of Northern Saskatchewan and some community colleges requested course outlines and personnel to teach these courses. Trade shows distributed information bulletins. Radio and television media have shown an interest in the courses, which are not available anywhere in Canada at present.

MONITORING AND ENHANCEMENT EQUIPMENT FOR AQUACULTURE SYSTEMS

OBJECTIVES

Project objectives are to develop Canadian-made equipment for oxygen and nitrogen gas measurements in aquatic environments and to develop enhancement measures that increase production of fish, both for table use and brood stock for egg supplies.

MILESTONES

Oxygen and temperature measurement equipment is now used in aquaculture research and production facilities, and nitrogen gas tensiometers are being developed for use in recycled and single pass fish culture facilities. The Saskatchewan Power Corporation is using the equipment at an Estevan aquaculture station, presently under construction.

Aeration equipment was developed for aeration of farm dugouts for domestic water use, as well as for fish culture overwintering programs. Oxygen enhancement for sports fishery lakes that have marginal winter kill, and enhancement of water quality in pond cage rearing projects is under way.

ADVISORY GROUP FOR AQUACULTURE IN SASKATCHEWAN

OBJECTIVES

The objective is to form a working group of producers, government and research personnel to identify problem areas of the aquaculture industry, to suggest remedies and to plan its orderly growth. This is following closely the position paper developed in July of 1983 at the first National Aquaculture Meetings

sponsored by Department of Fisheries and Oceans and the National Science Council of Canada.

The first advisory group met with SRC on November 29, 1983.

SEDIMENTARY LABORATORY R 742-4

OBJECTIVES

This laboratory provides sedimentary analyses, primarily textural and carbonate analyses, of unconsolidated sediments, commonly tills, sands, and gravel deposits. The purpose is to determine properties of the materials which enables identification and stratigraphic correlation of these geologic units. These results are used in SRC resources projects such as Quaternary geology, aquifer evaluation and the aggregate inventory. The laboratory also provides services, not available elsewhere in the province, to the private sector, especially consultants and to government departments.

The project is primarily core-funded, although the laboratory's unique services are regularly used by outside contract clients.

MILESTONES

Sedimentary analyses have been done on numerous samples from SRC research projects involving test drilling at Nipawin, Regina, and the Saskatoon area, particularly the Dalmeny research work. In total, several thousand sedimentary analyses have been done this year.

The laboratory provides unique, up-to-date analyses of sedimentary deposits which are not commercially available elsewhere. In addition, all analytical records and samples analyzed are stored for future reference to provide valuable background data for such studies as pollution migration, and are also available for re-analysis by different methods for other properties pertinent to further research.

QUATERNARY GEOLOGY R 743-4

OBJECTIVES

The objectives of this project are to map, describe, and analyze glacial and recent sediments deposited during the Quaternary period, and to study the processes that formed these sediments and landforms; to apply this geologic information to geotechnical problems that will facilitate the delineation and evaluation of mineral, groundwater, aggregate and other resources in Saskatchewan. The project is approximately 60 percent core-funded.

MILESTONES

During 1983, coring of fossiliferous silts was done at Regina for multifaceted investigations to define a chronostratigraphic marker horizon within the regional stratigraphic framework. Field work including test-drilling was done in the Nipawin area in conjunction with archaeological studies being carried out by SRC. A paper "Lake Agassiz in Saskatchewan" has been published in The Geological Association of Canada Special paper No. 26 as part of the Lake Agassiz Symposium. A paper on the Quaternary geology of the Wollaston area has been published as part of the National Energy Agency - International Atomic Energy Agency research program on uranium exploration methods (Geological Survey of Canada Paper 82-11). The final report on the Quaternary geology of the Precambrian Shield area, Saskatchewan is now in press. (Saskatchewan Energy and Mines Report #221).

These geological studies established the background or setting for numerous resource investigations such as groundwater evaluation, geotechnical studies, aggregate inventories, and mineral exploration.

SURFICIAL MAPPING R 743-6

OBJECTIVES

The objective of this program is to compile a series of maps at a scale of 1:250,000 that will identify and delineate surface materials and landforms in southern Saskatchewan. This information will be combined with the maps already compiled for the Precambrian Shield area to produce a 1:1 million scale map of Saskatchewan. The mapping and description of glacial sediments will be used in groundwater studies, sand and gravel resource development and general geotechnical studies. The project is core-funded.

MILESTONES

Field work this year required a ground check of the map information. Approximately 85 per cent of the compilation of the geology for the 1:250,000 scale maps is completed. The surficial geology of the southern part of Saskatchewan and the Precambrian Shield area have been compiled. The remainder of the province will be added to complete the manuscript map within the year.

This work involves compiling existing reports, maps and other information and applying aerial photograph interpretation along with some field checking. The resulting maps will conform to a consistent format and will display the most current knowledge on the surface deposits. The 1:250,000 scale maps will provide information that can be applied to the evaluation of groundwater resources, particularly recharge studies, the inventory of aggregate resources, and to aid in solving geotechnical problems concerning sediments. The 1:1 million map will provide an overall picture of the surface material of Saskatchewan and will complement the bedrock geology map of the province recently revised.

AGGREGATE RESOURCES OF SASKATCHEWAN R 743-7

OBJECTIVES

This project compiles an inventory of the aggregate (sand and gravel) resources of Saskatchewan plains in terms of location, extent, quantity, quality and characterization, as an aid to local and regional development. Demand for aggregates continues to grow in Saskatchewan, the primary users being the construction and road-building industries. As sources near major cities are exhausted, supplies must be located and transported from sources farther afield. The transportation costs form a major component in the cost of the aggregate to the end user.

MILESTONES

A series of reconnaissance level maps at scale 1:250,000 should be completed within the year. These maps which combine surficial and sub surface geology information with data on known aggregate deposits will indicate areas of potential for aggregate resources. More detailed studies have been done in the Saskatoon area which involve exploration and investigation of deposits using aerial photograph interpretation, field checking, augering, geophysics, sampling and analyses. The aggregate deposits will be shown on maps at scale 1:50,000 with accompanying data on quantity and quality of the aggregate in the deposits.

The regional monitoring will indicate potential aggregate resources and provide information on known deposits which will reduce exploration costs to government departments and particularly to cities, towns, rural municipalities and private contractors. The inventory will also provide a framework for resource management and utilization over the long term.

OBSERVATION WELL NETWORK R 744-5

OBJECTIVES

SRC's observation well network measures groundwater level fluctuations and relates them to changes in recharge caused by climatic variation. Data obtained from the network are used as baseline information for other hydrogeological studies, and eventually, for evaluation of aquifer performance under the stress of in-

dustrial developments.

MILESTONES

The network was maintained at a level of 50 wells this year, although initial steps have been taken to expand the observation well network to also measure water-levels in deep formations.

A program of well maintenance was carried out to ensure continuation of accurate water level measurements in the future.

Observation wells were sampled as part of a systematic investigation of long-term natural water quality changes.

SRC's observation well network has produced data since the 1960's. The 50 wells each provide an average coverage of 2000 square miles (5180 km^2) in the southern agricultural part of the province.

GROUNDWATER INFORMATION
R 744-7 (CORE RESEARCH)

OBJECTIVES

This project maintains and updates geology and groundwater data banks, and on request, provides geology and groundwater information to government, consultants, scientists, and the general public.

A micro-computer was acquired this year to aid in data storage and retrieval of information.

MILESTONES

This year several hundred Family Farm Improvement Branch groundwater well logs were acquired and used to supplement existing data.

Approximately 75 requests for groundwater information were received, primarily from individual farmers. From the records of groundwater data, advice was given on the quality and quantity of water available in particular areas.

AQUIFER EVALUATION AND RESEARCH
R 744-4 (CORE RESEARCH)

OBJECTIVES

The objective of this project is to provide a comprehensive inventory of Saskatchewan's groundwater resources for the purpose of proper development and management, and to establish and understand groundwater regimes and groundwater quality.

MILESTONES

In co-operation with the University of Waterloo, a project to study recharge and flow through till.

A program has been initiated to systematically study the hydrographs from SRC observation wells. Initially, this study will concentrate on analysis of fluctuations caused by barometric pressure changes and earth tides.

A computer model has been developed to estimate the potential yield of the Estevan Valley aquifer.

Two papers of note were presented by staff this year. At the Annual Meeting of the Canadian Water Resources Association: "Observation Wells in Saskatchewan Canada"; at the Potash '83 Conference in Saskatoon: "Influence of a Potash Tailings Pile on Groundwater Flow: A Case History in Saskatchewan, Canada".

GEOLOGY AND GROUNDWATER RESOURCES OF THE SASKATOON AREA R 743-8

OBJECTIVES

The objectives of this program are to provide a comprehensive inventory of geology and groundwater

resources in the Saskatoon area. This will include the identification, delineation and evaluation of surficial, intertill, buried valley and bedrock aquifers, and will identify interrelationships among aquifers. This is the first one of a new information series designed to update and expand on the original geology and groundwater resources map series. The project is entirely core-funded.

MILESTONES

All pertinent testhole and water well information has been collected and reviewed. The compilation of results will begin in early 1984, with completion scheduled for mid-summer. Maps will show the extent, thickness and depth to the various aquifers that occur in the area. Ten cross-sections will illustrate the stratigraphic relationship of the geologic units, in particular, the aquifers. Water quality based on analyses of numerous water samples will also be shown on the maps. A report will explain the geology and groundwater conditions in the area. A computerized file of the basic information will provide ready access to particular data for site specific investigations.

This new geology and groundwater information series will provide the most current data and interpretations concerning water supplies, and will assist industry, cities, towns, and individuals in exploring for water resources. It will also provide the background for assessing the water supplies which will optimize the use of the resource and will minimize any hazardous effects of development.

ENERGY CONSERVATION R 825

OBJECTIVES

The objectives of the program remain unchanged: to research, develop and transfer technology to residential energy conservation. More than 30 reports have been issued in the past year.

MILESTONES

The Air-Vapour Barrier report is in great demand and has now run into its fourth edition. It is being published and distributed in French and English by Energy, Mines and Resources (EMR). It is estimated that more than 10,000 copies have now been distributed.

The Handbook on Airtightness Sealing was completed in the fall of 1983, and is considered to be one of the most important products of the BETT Program (Building Energy Technology Transfer). It is currently under review, and it is planned to use this as a basis for a national standard on sealing.

The staff of the Energy Program were responsible for drafting a Canadian General Standards Board standard on insulated cladding systems for housing. It is planned to apply this standard nationally, as part of the operations of the Canadian Home Insulation Program (CHIP).

The Energy Program is now playing a leading role in the development of a national standard for energy-efficient housing construction in northern Canada, under a contract from EMR.

The staff of the Energy Program have devised a technique for removing formaldehyde from house air, using an air washer mounted in the furnace ducting. Research on this concept is proceeding under a contract from the UFFI Centre, Department of Consumer and Corporate Affairs.

SERVICES SECTOR

ANALYTICAL SERVICES S 803-1

OBJECTIVES

This project undertakes chemical analyses, on a contract basis, of a wide range of industrial, environmental and research project samples.

MILESTONES

The general economic downturn experienced this year has resulted in a 40 per cent decrease in

revenues, and an equivalent reduction in staff. However the quantity of incoming work has now levelled off, and should be maintained, at least in the near future.

The types of chemical analyses remains the same: about 70 per cent of the work involves environmental monitoring samples such as water, soil, vegetation, sediment, and occasionally wildlife. The samples are analyzed for major and trace constituents, including herbicides, pesticides and trace metals. Two unusual jobs were undertaken this year: one involved the health effects of sour gas emissions in Pincher Creek, Alberta; the other, testing natural radiation in rural well water in southern Manitoba.

In total, 10,000 - 15,000 samples will be analyzed this year.

The Analytical Laboratory continues to be the principal resource for chemical analyses in Saskatchewan. However, this year the facility and available expertise were also contracted to out-of-province clients. This category of work totalled $50,000, or about 6-7 per cent of the entire work volume.

ANALYTICAL RESEARCH, S 803-4

OBJECTIVES

The objective of this program is to develop new analytical techniques and methodologies for special, one-time analyses of materials resulting from unusual problems encountered by clients. The new analytical techniques and methodologies may also be transferred to the companion project, Analytical Services, if clients and the market require.

MILESTONES

Work continued this year on developing new procedures for the analysis of uncommon herbicides and pesticides. This reflects the continuing importance of environmental monitoring analyses in the whole work load of the laboratory.

New initiatives this year responded to the needs of Saskatchewan's resource sector. Applications of neutron activation analysis were developed to aid in the exploration for gold in Saskatchewan. The price commanded by gold has made deposits northeast of La Ronge and around Flin Flon economically attractive, and development may proceed in the future. SRC's Analytical Laboratory will have an important role in the exploration process, as it presently has in the uranium mining sector.

GEOCHEMICAL SERVICES S 801-1

OBJECTIVES

The mining and exploration industry in Saskatchewan regularly requires laboratory analysis of field samples to direct the course of exploration work and future production programs. This project services the industry by providing reliable, economical, high volume geochemical analyses of rocks, ores, minerals and sediments. The services are also available to other SRC projects in the resources field.

MILESTONES

The project regularly provides geochemical services to seven major clients, including AGIP Canada Limited, Saskatchewan Mining Development Corporation, Uranerz, Eldor Resources, Key Lake Mining Corporation, Sask Oil, and Saskatchewan Department of Energy and Mines. In addition, many small clients, including a number of individual prospectors, occasionally request geochemical services. The project expects to perform about 15,000 analyses this year.

New equipment has been acquired this year: automated analytical equipment and computers that will permit a high degree of reliability, productivity and flexibility in the service.

GRAPHICS A 752-4

OBJECTIVES

This program provides a comprehensive graphics product and consulting service, including cartography, drafting, photography, photomechanical, audio-visual and display production to SRC, government and industry. The facility includes an in-house copy centre for electrostatic reproduction.

MILESTONES

Consultation provided to government continues to be an important service. A total of eight government departments and agencies have adopted aspects of Graphic Services operating systems. Significant benefits have accrued to the Department of Highways in its annual revision of the provincial highway map.

Graphic Services is the Saskatchewan Co-ordinator for Airborne Remote Sensing of the Canadian Centre for Remote Sensing.

The Map/Air photo Library provides a unique resource in the cartography of the province. The collection includes all published topographic maps available for the province. Air photos include a complete historic provincial set produced from 1939 to 1945, and the only collection of 1:50,000 photo mosaics of the entire province.

INFORMATION CENTRE A 753

OBJECTIVES

The Information Centre exists primarily to provide library and information services to SRC staff. Externally, it serves researchers and students in academic or technical studies, other libraries and, on a fee-for-service basis, various clients in consulting and industry.

MILESTONES

Journal holdings in science and technology, now number over three hundred titles. A modern reference collection, comprised of encyclopedias, directories and current bibliographic tools, and book and government publication holdings totalling thirty-five thousand items assist research staff with their needs.

Access to over two hundred databases provides online retrieval of current information in the various disciplines at the Council.

The automated CODOC program, with complete cross-referenced printout indexes, facilitates access to a government publications collection which now totals over 8000 documents. A companion CODOC-based catalogue indexes the SRC technical reports archive.

New systems in the Information Centre this year include automation of accessions and journals holdings information. A library newsletter is published periodically to enable the Centre's staff to communicate information while it is current.

CANADIAN CENTRE FOR ADVANCED INSTRUMENTATION X 795

OBJECTIVES

The centre exists to improve efficiency, effectiveness, and quality in industry, government and education through the use of measurement and control instrumentation. CCAI aims to be internationally recognized as a resource centre for advanced instrumentation. The Centre is partially funded by a grant from the federal Department of Regional Industrial Expansion.

MILESTONES

In 1983 the centre completed development of a prototype automated air sampling system, for the Canadian Department of National Defence, and proceeded with development of an automated minitube adsorber packer for use in conjunction with the air sampler.

The centre conducted two design evaluations of Saskatchewan manufactured electronic products, and

three feasibility studies for the potential use of micro-electronics by small Saskatchewan industries in their products and processes. The development of a micro-electronics capability by Saskatchewan industries is necessary to maintain a competitive position, and benefit from the available productivity increases.

The centre continued production of prototype printed circuit boards, and provided electronics servicing to Canadian clients. Third party maintenance agreements were concluded with two major instrument suppliers.

The Precision Instruments Group continued production of specialized plastic components, rotary fusion burners, and water level recorders. The centre exported burners to the United States, India, and Madagascar.

Two years of field experiments by aquaculture specialists in the Environment Sector have demonstrated marked improvements in quality and quantity of fish, compared to traditional dugout production. Here, four fish-rearing cages are in operation at the SRC Aquaculture facility.

CAD/CAM design technology (computer-aided design/computer-aided manufacturing) is demonstrated to Saskatchewan manufacturers by staff of the Industrial Technology Transfer Sector. Allan Malinoski at left and Dave Grier at the terminal.

Samples of the mushroom **Pleurotus ostreatus** are grown on straw and hay by Resources Sector Biomass Program staff to simultaneously produce a high value edible product, and improve the feed value of the straw and hay for livestock.

Cartography is an essential component of the production in the Services Sector Graphics Program. Here, Carlos Sardinha and Brian McIntosh work on a site plan map for PCS Mining Ltd.

PUBLICATIONS OF THE COUNCIL'S STAFF

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S.R. Shewchuk
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K. Wallace
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S.R. Shewchuk, R. Grover
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J.T. Finnigan
January, 1983
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M.G. Hanna
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R. Barclay
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R. Arnold
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R.G. Arnold
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June, 1983
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CONFIDENTIAL REPORTS

The following reports were done under contract, and are considered proprietary information. They may be released subject to approval by the client and sector director.

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February, 1983
SRC Publication No. G-744-3-C-83

Review of Monitoring Data 1968-1982 and Control and Monitoring of Subsurface Brine Migration at the Cominco Ltd. Waste Disposal Site, Vanscoy, Saskatchewan
H. Maathuis and G. van der Kamp
March, 1983
SRC Publication No. G-744-4-C-83

Analysis of Soil Resistivity Measurements Using Installed Borehole Sensor Arrays
J.H. Dyck
September, 1983
SRC Publication No. R-782-4-C-83

Case Study: The Monitoring and Analysis of House Thermal Performance
D. Eyre
February, 1983
SRC Publication No. E-825-3-C-83

Aquaflow Test
R. Wong
June, 1983
SRC Publication No. R-825-15-C-83

Chemical Reactivity of Cluff Lake Dolomite with Claude Ore Leach Residues
J.H. Hudson
January, 1983
SRC Publication No. E-830-1-C-83

A Literature Survey on Solvent Extraction of PCB's from Soil
F. Barnes, J. Hudson, W. Spyker
February, 1983
SRC Publication No. E-830-2-C-83

Testing on Neutralizing Cluff Lake Stage II Wastes with Lime, Calcined Dolomite, and Raw Dolomite
J.H. Hudson
July, 1983
SRC Publication No. R-830-4-C-83

Prototype Remote Rock Deformation Measurement System
Initial Test Report with Recommendations for Future Installations
J.T. Jones
September, 1983
SRC Publication No. R-830-6-C-83

SERVICES SECTOR

Annual Compliance Report (April 1, 1982 to March 31, 1983) for Atomic Energy Control Board, Canada
G.L. Smithson
July, 1983
SRC Publication No. S-803-2-C-83

SRC TECHNICAL REPORT NUMBERS

137 A Snowpack Chemistry Study of Small Lakes in Northern Saskatchewan
S.R. Shewchuk
August, 1982
(also SRC Publication No. P-780-15-B-82)

138 A Theoretical Estimate of Hydro-Coil Energy Savings
D. Eyre
November, 1982
(also SRC Publication No. E-825-55-B-82)

139 Climatological Reference Station, Annual Summary, 1982
J.L. Bergsteinsson, J.G. Calvert
January, 1983
(also SRC Publication No. P-784-1-B-83)

140 Desalination of Brackish Water by Spray Freezing
Progress Report 1981-82
J.W. Spyker
November, 1982
(also SRC Publication No. E-835-3-B-82)

141 Enzymatic Hydrolysis of Mulit-use Forage Energy Crops
Year 2 Report
Studies on the Improvement of Reaction Conditions
Differences Between Forages
L.J. Jackson, E.C. Coxworth
March, 1983
(also SRC Publication No. C-711-6-B-83)

142 Continuous Ambient Monitoring for Trace Levels of Organic Pesticide
S.R. Shewchuk
April, 1983
(also SRC Publication No. E-906-1-B-83)

143 A Micrometeorology System as it is Applied to Herbicide Volatization Under Field Conditions
S.R. Shewchuk, R. Grover
March, 1983
(also SRC Publication No. P-780-5-B-83)

144 Low Temperature Lignite Liquefaction
Fred Barnes
October, 1982
(also SRC Publication No. E-830-5-B-82)

145 Hatfield Valley Aquifer System in the Melville Region, Saskatchewan
B.T. Schreiner, H. Maathuis
August, 1982
(also SRC Publication No. G-743-3-B-82)

146 Graphics Software for Data Analysis: III. Histogram Program-user's Guide
J.W.J. Smith and M. Mellinger
August, 1983
(also SRC Publication No. R-740-5-G-83)

SCHOLARSHIPS

The Government of the Province of Saskatchewan offers graduate research scholarships, tenable at either the University of Saskatchewan or the University of Regina. The purposes of the awards are to assist graduate students to prepare for careers in scientific and industrial research, and to create interest in the exploitation of Saskatchewan's resources and in techniques that will advance the development of the Province. SRC conducts the selection of the candidates.

Awards valued at $8,200 for the year beginning May 1, 1983 were made to:

Michael J. Bidochka, Biology Department
University of Regina

Karen S. Bolton, Geography Department
University of Regina

Frederick Frankling, Crop Science Department
University of Saskatchewan

GRANTS-IN-AID 1983-84

Since its creation in 1947, the Saskatchewan Research Council has provided grants to applicants in Saskatchewan Universities for applied research in the sciences. Twelve ongoing projects were allocated $76,000, and six new proposals received $33,800. Of the total Grant-in-Aid award of $110,400, five University of Regina projects received $34,500, and 13 University of Saskatchewan projects received $75,900.

The following projects are presently receiving support under the grants-in-aid program:

UNIVERSITY OF REGINA

Department of Biology
M.V.S. Raju; W.A. Quick
Morphological and biochemical studies on induction of dormancy in developing caryopses of Avena fatua (wild oat).

Department of Chemistry
K.E. Johnson
Chemical studies of acid rain impact.

Department of Engineering
J. Mozel
CAD/CAM service and research centre.

Department of Geology
G.R. Parslow
Trace elements (particularly base metals of economic interest) in the Flin Flon volcanics.

Regional Systems Engineering
F.A. Curtis
Transportation energy modelling in subdivisions: Year 2.

UNIVERSITY OF SASKATCHEWAN

Department of Agricultural Engineering
J.A. Gillies; J.M. Murray
Artificial recharge of groundwater.

Department of Applied Microbiology and Food Science
G.A. Jones; W.M. Ingledew
Production of ethanol and other liquid fuels from biomass by syntrophic fermentation.

Department of Chemistry
R.J. Woods
Neutron activation analysis of trace elements in soil.

Department of Civil Engineering
D.G. Fredlund
Use of filter paper to measure matric suction for geotechnical purposes.

Department of Civil Engineering
E.K. Sauer
Hydrogeology of till deposits in Saskatchewan.

Department of Crop Science and Ecology
E.A. Ripley
Modelling wheat growth and development.

Department of Geological Sciences
L.C. Coleman; M.R. Stauffer; E.G. Nisbet
Further geochemical studies of Flin Flon volcanics.

Department of Geological Sciences
H.E. Hendry
Petrology and diagenesis of the Athabasca group, northern Saskatchewan.

Department of Home Economics
A.K. Sumner
Effect of immaturity and harvesting method on cereal crop quality.

Department of Horticulture Science
C. Stushnoff; A.R. Olson
Influence of low temperature stress on fruit set in Saskatoon berry.

Department of Mathematics
D.W. MacLean
Optimization of log breakdown patterns in sawmills.

Department of Physics
K.V. Paulson
The development of the magnetotelluric method for resource exploration in Saskatchewan.

Department of Soil Science
P.M. Huang
The nature and properties of current and potential acidity of soils in Saskatchewan.

SASKATCHEWAN RESEARCH COUNCIL STAFF

Mr. J.P. Hutch	B.E., P.Eng. — President	* Dr. T.P. Pepper	B.A., M.A., Ph.D. — President

INDUSTRIAL TECHNOLOGY TRANSFER SECTOR

Scharf, A.	B.Sc., P.Eng., C.M.C. — Director	Jahren, C.	B.A.
		Karsan, A.	B.Sc., P.Eng.
		Kuchinka, C.	B.E., P.Eng.
Chan, R.	B.A.Sc., P.Eng.	Levesque, R.	B.E., P.Eng.
Cooke, G.	B.Sc., P.Eng.	Maithel, R.	B.Sc., M.Sc., P.Eng.
Dziad, C.	B.A., B. Comm.	Malinoski, A.	B.E., B.Sc., P.Eng.
Florizone, D.	Mech. Eng. Tech.	Pierce, G.	B.Sc., M.Sc., P.Eng.
Glossop, D.	L.M.I., P.Eng.	* Rawa, A.R.	B.Sc., P.Eng.
Grier, D.	B.E., B.Sc., P.Eng.	Zuk, B.	B.E., B.A., P.Eng.

ENVIRONMENT SECTOR

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		Nicolichuk, N.	Civ. Eng. Tech.
Abouguendia, Z.	B.Sc., M.Sc., P.Ag.	Paquin, B.	R.R. Tech.
* Barclay, R.	B.Sc.	Peters, M.L.	
Beaulieu, C.	B.A.	Polson, J.	B.Sc.
Begrand, R.	B.Sc.	Richert, D.	R.R. Tech.
Bindle, K.		Ross, J.	
Bouvier, R.		Russell, D.	B.A., M.A.
Calvert, J.		Sawchyn, W.W.	B.A., M.A., Ph.D.
* Ediz, S.	B.Sc., M.Sc., Ph.D.	Shewchuk, S.R.	B.Sc., M.Sc., Ph.D.
Ferris, W.	B.A.	Smith, B.J.	
Finnigan, J.	B.A., M.A.	Swanson, S.	B.Sc., Ph.D.
Godwin, R.C.	B.S.A.	Tones, P.	B.S.A., M.Sc., Ph.D.
* Hanna, M.	B.A., M.A., Ph.D.	Wallace, K.W.	B.Sc.
Jahren, R.	R.R. Tech.	Wheaton, E.	B.Sc., M.Sc.
Klimko, O.	B.A., B.Ed.	Whiting, J.	B.Sc., M.Sc.
Lakshman, G.	B.A., M.Sc.	Wilson, J.	B.A., M.A.
MacPherson, R.J.		Yoshida, K.	B.Sc., Ph.D.
McKeand, P.	B.A.		

RESOURCES SECTOR

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	Arnold, R.G.	B.Sc., M.Sc., Ph.D. — Assistant Director
	Adolph, P.	
	Barnes, W.B.	B.E., P.Eng.
	Bilewski, Z.	
*	Brosseau, J.	B.Sc., M.Sc., Ph.D.
	Campbell, J.	B.Sc., B.A.
	Coxworth, E.	B.A., M.A., Ph.D.
	Craig, W.	B.Sc., Ph.D.
	Darrach, W.A.	
	Davidson, R.	B.Ed.
	Dyck, J.	B.E., B.Sc., Ph.D., P.Eng.
	Eyre, D.L.	B.Sc., M.Inst.P.
*	Filson, H.	B.E., M.Sc., P.Eng.
	Gillies, R.	B.E., M.Sc., P.Eng.
	Gimby, M.	Dip. Agr.
	Gleadhill, M.	
	Haas, D. J.A.	B.E., M.Sc., P.Eng.
	Hoeve, J.P.	B.Sc., M.Sc., Ph.D.
	Hudson, J.	B.A., M.A.
*	Hunt, G.	B.A., M.A., B.Ed.
	Jackson, L.	B.Sc.
	James, D.	B.Agric.
	Jaworski, E.	R.R. Tech.
	Jennings, D.R.G.	
	Jones, J.T.	B.A., I.Tech.
	Kernan, J.A.	B.Sc., M.Sc.
	Kullman, P.	
	Lehtinen, J.	B.A., B.Sc.
	Luc, S.	
	Lychak, J.	
	Maathuis, H.	B.Sc., M.Sc.
*	Maier, M.	Bio.Sc. Cert.
	McKenzie, C.T.	B.Sc., M.B.A., P.Eng.
	McKnight, R.	
	Mellinger, M.	B.Sc., M.A.Sc.Doc.Spec.
	Niyazi, S.	
	Quirt, D.	B.A.Sc., M.A.Sc.
	Rackel, J.	
	Reich, R.D.	Arch. Tech.
	Ross, W.C.	B.Sc.
	Rutherford, A.	B.E., M.Sc.
	Schergevitch, P.	
	Schreiner, B.T.	B.Sc., M.Sc., P.Eng.
	Simpson, M.	B.A.
	Small, M.	Chem. Tech.
	Smith, J.W.J.	B.Sc.
	Sosulski, K.	M.Sc., Ph.D.
	Sulatisky, M.	B.E., M.Sc., P.Eng.
*	Thomanek, W.	B.Sc.
	Turple, L.	B.Sc.
	van der Kamp, G.	B.Sc., M.Sc., Ph.D.
	Warkentin, T.	Chem. Tech.
	Wong, R.	B.E., P.Eng.
	Zlipko, D.	

SERVICES SECTOR

	Spyker, J.W.	B.E., M.Sc., P.Eng. — Director
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	Barabas, A.M.	
	Bell, B.	
*	Bowers, M.	
	Calderon, G.	
*	Carr, M.	B.A., M.L.S.
	Cherepacha, V.	
	Chorney, D.	Chem. Tech.
	Collins, D.	
	Cutts, S.	
	DeGirolamo, M.	
	Diduck, D.	
	Didur, L.	
	Drader, G.	Chem. Tech.
*	Duff, T.	Lab. Tech.
	Fahri, M.	B.Sc.
	Forsythe, C.	Chem. Tech.
	Gartner, B.J.	
	Gilroy, B.	
*	Goran, B.	
	Grimsen, A.	
	Hargrave, S.	
*	Hickerson, V.	
	Holsten, A.	B.Sc.
*	Horechka, M.	
	Jackson, A.	
	Janzen, L.	
*	Johnson, M.	

* Johnston, M.		Penner, V.	
Jones, L.A.		Perkins, E.H.	Civ. Tech.
Khosla, I.		* Peters, J.	
Klassen, B.H.	Chem. Tech.	Piek, H.	
* Knelson, M.	Chem. Tech.	Popoff, F.	
Koolick, P.		Punani, S.	
Kosteniuk, K.		* Prentice, J.	B.A.
* Kwan, W.	Chem. Tech.	* Rasmussen, R.	R.R. Tech.
* Lane, F.	Chem. Tech.	* Reid, L.	B.Sc.
Lutz, M.		* Rickard, C.	R.R. Tech.
Ma, J.	B.Sc.	Rielkoff, W.	
MacDonald, L.A.		Rutherford, L.	B.Ed., Chem. Tech.
MacEwan, H.A.		Samms, M.	Lib. Tech.
Makohoniuk, M.		Sardinha, C.	C.C.
Mangatal, S.		* Schaffer, T.	
Marshall, B.		Sharma, V.	B.A.
McEwan, D.		Smithson, G.	B.Sc., M.Sc., Ph.D., P.Eng.
McGrath, R.J.	B.Sc., M.B.A., R.I.A. — Treasurer	Sopher, L.	B.Ed.
McIntosh, B.	C.C.	* Tanioka, K.	
McNeill, B.		Taylor, W.E.	C.C., CASI
Meginbir, G.A.	B.A.	Ty, L.	B.Sc.
Melvin, R.E.	B.E., P.Eng.	Voth, T.	
Millhouse, M.		* Waldal, C.	Chem. Tech.
Moser, P.	Chem. Tech.	Weber, B.L.	
* Nemeth, L.		Weegar, E.L.	
Opsal, J.O.	B.Sc., P.Eng.	Will, M.P.	B.Ed.
Oro, F.	B.Sc., M.Sc.	Wittenburg, J.	
* Ortlepp, R.		Woytowich, G.	
* Ottman, A.		Wright, J.	
Owens, K.A.		Yuen, W.	B.Sc., Ph.D.

CANADIAN CENTRE FOR ADVANCED INSTRUMENTATION

Barnett, D.	NBTI — Director	Olm, O.	
Beeton, G.	B.E.	Ostwald, W.	
Heinze, R.		Pinchbeck, R.	
Locke, T.	B.Sc., M.Sc., P.Eng.	Woods, D.	Elec. Eng. Tech.
Matieshin, R.T.		Young, K.	B.Sc., Elec. Tech.

SPECIAL PROJECTS

Bergsteinsson, J.L.	B.A., B.Sc., B.Ed. — Director	Fothergill, D.	B.A.
		Ross, W.H.	B.Sc., M.Sc.
* Cody, B.	B.A., M.A.	Limet, M.	
Erickson, B.	B.A.		

* Terminated Employment in 1983.

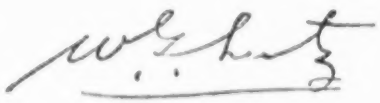
FINANCIAL STATEMENTS

AUDITOR'S REPORT

To the Members of the Legislative Assembly
Province of Saskatchewan

I have examined the balance sheet of the Saskatchewan Research Council Fund as at March 31, 1983 and the statements of revenue, expenditure and fund balance, and changes in financial position for the year then ended. My examination was made in accordance with generally accepting auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Fund as at March 31, 1983 and the results of its operations and the changes in its financial position for the year then ended in accordance with the stated accounting policies applied, after giving retroactive effect to the change in accounting for accrued vacation and benefits payable as explained in Note 7 to the financial statements, on a basis consistent with that of the preceding year.



Regina, Saskatchewan,
June 10, 1983

W. G. Lutz, F.C.A.
Provincial Auditor.

SASKATCHEWAN RESEARCH COUNCIL FUND

BALANCE SHEET

MARCH 31

ASSETS	1983	1982
Current:		
Accounts receivable	$1,822,876	$2,032,748
Prepaid expenses	48,210	27,793
	$1,871,086	$2,060,541
Other assets	3,939	3,933
Fixed assets (Notes 1(b) & 3)	1,672,754	1,815,995
	$3,547,779	$3,880,469

LIABILITIES AND FUND BALANCE

Current:		
Bank Indebtedness	$ 610,573	756,185
Research grants payable	117,652	91,817
Accounts payable	471,165	590,844
Employee deductions payable	195,258	186,800
Retroactive salaries payable	199,881	43,395
Deferred revenue (Note 5)	332,833	103,840
Current portion of conditional sales contract (Note 4)	91,862	82,020
Vacation and benefits payable (Note 7)	284,490	374,416
	$2,303,714	$2,229,317
Long Term:		
Conditional sales contract (Note 4)	102,886	194,748
Deferred revenue (Note 5)	460,956	545,627
Fund balance - Statement 2	680,223	910,777
	$3,547,779	$3,880,469

(See accompanying notes to the financial statements)

Statement 2

SASKATCHEWAN RESEARCH COUNCIL FUND

STATEMENT OF REVENUE, EXPENDITURE AND FUND BALANCE

Year Ended March 31

	1983	1982
Revenue:		
Contracts	$ 6,282,028	$ 6,686,611
Grant - Government of Saskatchewan	3,518,830	3,065,300
Interest	———	138,529
Other (Note 5)	301,497	227,756
	$10,102,355	$10,118,196
Expenditures:		
Salaries	6,386,294	5,913,113
Employee benefits	602,690	510,487
Supplies and technical services	1,682,610	2,201,011
Depreciation (Note 1(b))	481,857	503,429
Travel and vehicle operations	269,158	295,316
Rent and utilities	375,009	374,689
Research grants	117,652	106,102
Other	417,639	551,261
	10,332,909	10,455,408
Excess of expenditure over revenue for the year	230,554	337,212
Fund balance, beginning of year		
As previously reported	1,285,193	1,428,597
Adjustment due to change in accounting policy (Note 7)	(374,416)	(180,608)
Fund balance, beginning of year, as restated	910,777	1,247,989
Fund balance, end of year - to Statement 1	$ 680,223	$ 910,777

(See accompanying notes to the financial statements)

Statement 3

SASKATCHEWAN RESEARCH COUNCIL FUND

STATEMENT OF CHANGES IN FINANCIAL POSITION

Year Ended March 31

	1983	1982
Source of funds:		
From operations		
Excess of expenditure over revenue	$(230,554)	$(337,212)
Add (deduct) charges (credits) not involving a flow of funds:		
Depreciation	481,857	503,429
Amortization of deferred revenue	(84,671)	(89,315)
Loss on disposal of fixed assets	———	9,778
Total source of funds	166,632	86,680
Application of funds:		
Increase of other assets	7	113
Reduction of conditional sales contract	91,862	82,020
Purchase of fixed assets	338,616	692,802
Total application of funds	430,485	774,935
Increase (decrease) in working capital	(263,853)	(688,255)
Working capital (deficiency) beginning of year	(168,775)	519,480
Working capital (deficiency) end of year	$(432,628)	$(168,775)

(See accompanying notes to the financial statements)

SASKATCHEWAN RESEARCH COUNCIL FUND
NOTES TO THE FINANCIAL STATEMENTS
Year Ended March 31, 1983

1. **Summary of Accounting Policies**

(a) Revenue Recognition

Revenue from the majority of contract work is recognized on the percentage-of-completion method which recognizes revenue as a contract progresses. Unbilled revenues are accrued to year end for these contracts, while pre-billed revenues are classified as deferred revenue.

Revenue from analytical lab work, involving shorter term contracts without substantial outlays of direct costs, is recognized on a completed contract basis.

(b) Fixed Assets

The assets of the Council are initially recorded at cost, including labour, material and overhead for self constructed assets.

Depreciation is provided over the estimated useful lives of the assets on the following basis:

(i) Sum of the years digits method	
Buildings	20 years
Leasehold improvements	5 years
Equipment	10 years
(ii) Declining balance method	
Automotive	33 ⅓%

(c) Pension Costs

The Council participates with its employees in a benefit based pension plan and in accordance with recommendations of the plan's actuary current service costs to the Council are charged to operations annually. Unfunded past service costs are being funded by the Council over a minimum of fifteen years and are being charged to operations accordingly.

(d) Research Grants

Research grants awarded annually by the Council to aid in funding approved research projects are charged to expenditure in the year in which costs are incurred on the projects.

(e) Occupancy Costs

Certain buildings have been built for the use of the Council by the Government of Saskatchewan at no cost to the Council. No provision for such costs if reflected in these financial statements.

2. Pension Plan

An actuarial study of the pension plan of the employees of the Saskatchewan Research Council carried out at the inception of the plan in May, 1974 indicated an unfunded liability of $88,613 representing the cost to the Council of providing full past service benefits to existing employees joining the plan. In accordance with the recommendation of the actuary, this liability is being funded over a fifteen year period with the balance of this liability at December 31, 1980 having been reduced to $56,284. As the result of a second actuarial valuation as at December 31, 1977 it was determined there was an additional unfunded liability related to past service costs in the amount of $403,559 which, again in accordance with the actuary's recommendation, is being funded over a fifteen year period. The balance of this second liability was reduced to $348,524 as at December 31, 1980.

The most recent actuarial valuation as at December 31, 1980 reported that, after allowance is made for the remaining contributions required to fund the previously determined liabilities, the plan had an accrued surplus of $65,384 as at December 31, 1980. For each of the above valuations, the method used to determine the actuarial surplus or liability was the accrued benefit cost method.

The actuary has recommended and the Council has agreed to continue to contribute to the plan at a rate of 9.5% of earnings less the employer's required contributions under the Canada Pension Plan. In the actuary's opinion, this contribution rate will be adequate to meet the obligations for benefits to be earned for future service and to extinguish the unfunded liabilities previously determined over a minimum time period, in each case, of fifteen years.

The next actuarial valuation is to be performed as at December 31, 1983.

3. Fixed Assets

	1983			1982
	Cost	Accumulated Depreciation	Net Book Value	Net Book Value
Buildings	$ 563,973	$ 281,748	$ 282,225	$ 320,407
Leasehold Improvements	418,334	389,185	29,149	53,922
Equipment	3,042,339	1,746,206	1,296,133	1,349,338
Automotive	266,812	212,565	54,247	81,328
Land	11,000	———	11,000	11,000
	$4,302,458	$2,629,704	$1,672,754	$1,815,995

4. Conditional Sales Contract

The Council has entered into a conditional sales contract with Atomic Energy of Canada Ltd. for the purchase of equipment in the amount of $401,305. The contract included a $51,305 down payment on July 1, 1980 and four annual instalments including interest at 12%. At March 31, 1983, the remaining instalments are as follows:

Due Date	Principal
July 1, 1983	$ 91,862
July 1, 1984	102,886
	$194,748
Less current portion	91,862
	$102,886

5. Deferred Revenue

The Council has deferred revenue of $545,627 from the Potash Corporation of Saskatchewan for prepaid rent of a pilot plant. The revenue is being reflected in the accounts by the sum of the year's digits method over the 10 year term of the agreement which commenced in the 1981-82 fiscal year. The current portion of this deferred revenue is $84,671 and is classified accordingly in the balance sheet while the amount of revenue included in revenue of the current year is $89,315 (1982 - $94,058).

6. Related Party Transactions

Related parties to the Council are Saskatchewan's Crown controlled departments, agencies and corporations. Transactions with these parties are recorded at normal market prices except for certain buildings built for the Saskatchewan Research Council's use by the Government of Saskatchewan at no cost to the Council as explained in Note 1(e).

7. Change in Accounting Policy

During the year the Council changed its accounting policy respecting accounting for accrued holidays carried over. Previously, the accrued holidays had been accounted for when the holidays were either taken or paid out. The Council has now adopted a policy of recognizing the cost when the holidays are earned. The effect of this change has been accounted for on a retroactive basis. The retroactive application of this change in policy has resulted in a decrease in equity at the beginning of the year of $374,416. Of this amount $193,808 relates to the 1981-82 fiscal year and $180,608 relates to the years prior to 1981-82.

8. Contingent Funding of Retroactive Pay

The Council has received approval of a request for additional funding of up to $111,000 related to retroactive salaries paid for the period October 1, 1982 to December 31, 1982. Receipt of this amount is contingent on factors which cannot be evaluated until the end of the 1983-84 fiscal year. As a result, provision for this funding has not been accrued in the financial statements as of March 31, 1983.

9. Comparative Figures

Certain comparative figures have been adjusted to conform to the current year's presentation.